He Korero Paihama Possum Research News

Issue 3 October 1995

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Manaaki Whenua
Landcare Research
NEW ZEALAND LTD

Editorial

This third edition of Manaaki Whenua - Landcare Research's ***He Kōrero Paihama - Possum Research News*** provides more examples of multidisciplinary possum research. In the first two editions, articles covered vaccines to reduce possum fertility, possum impacts on vegetation, den behaviour, changing patterns of tuberculosis prevalence, biodegradation of 1080 in water, optimizing bait station use, new trapping standards for possums, and methods for monitoring the effectiveness of control. The scope of research at Landcare Research is further highlighted by material in this edition. In future, you can anticipate articles on the benefits of control for ecosystems, Tb incidence, and increasing community involvement in wildlife management.

The last issue of ***He Kōrero Paihama*** outlined our most significant Foundation for Research, Science and Technology (FRST) research programmes. Other funding for research comes from the Animal Health Board (AHB), the Department of Conservation (DoC), and private companies such as Tasman Forestry Ltd. As well as providing funding, AHB and DoC are major contributors in defining research needs.

Tasman Forestry has established a Research Fellowship for developing fertility-based biological control for possums. Tasman Forestry Research Fellow, Janine Duckworth, outlined exciting progress being made in this field in the first issue of ***He Kōrero Paihama***.

Some of our research projects on conventional pest control technology and new products are commercially sensitive and are covered by confidentiality agreements. Nevertheless, as soon as a useful new product or tool for possum control is developed we will usually highlight this in our newsletter. One such example comes from a research programme that resulted in the launch of CAMPAIGN®, a new toxic bait for possum control.

CAMPAIGN® represents the first of a series of new products designed to complement the traditional range of possum control tools. Since the National

Science Strategy Committee for Possum and Bovine Tuberculosis recognised that over-reliance on a single toxin, such as 1080, is unwise, the AHB was proactive in this regard and funded research into alternative toxins, baits, and delivery systems. CAMPAIGN® is more effective at killing possums than the slow-acting anticoagulant toxins such as brodifacoum or pindone, particularly in medium or high-density populations. Used in bait stations CAMPAIGN® bait will pose low risk to birds and secondary poisoning risks are also low (see CAMPAIGN® article for further details). This new bait is readily available over the counter and, unlike 1080, cyanide, or phosphorus, requires no special individual licence for its use.

In addition to our skills in toxicology and pest control, Landcare Research scientists have backgrounds in ecology, wildlife management, physiology, and gamete biology. To complement existing skills we have recruited new scientists with specialist knowledge in reproductive and hormonal physiology, gamete biology, and biometry to accelerate our biological control research. We are also seeking another experienced wildlife toxicologist to work on toxicology and the improvement of conventional control techniques. To encourage New Zealand graduates to enter these specialist fields Landcare Research has introduced summer scholarships. These will allow graduates to work alongside our researchers.

We hope that many of them will complete PhDs then come back to us in the future as researchers with new skills and energy to combat the threat that possums and other vertebrate pests pose to conservation and primary production in New Zealand. Closer collaboration between ourselves, other CRI's, and universities, is also being encouraged.

***Charles Eason**, Team Leader, Pest Control Technology, Landcare Research, Lincoln.*

Possum Induced Collapse of Forests

Over the last fifty years, possums in the canopy and deer and goats in the understorey have been responsible for an unprecedented amount of forest collapse in the southern Ruahine Range. The Ruahines, therefore offer opportunities to examine how forest composition and topography predispose stands to damage if possums are not controlled. Results from this research will be useful in looking at long-term trends in forest health over the rest of New Zealand, as currently possums are controlled in only about 15% of our forests.

Amount of forest collapse

There is a wide range of forest types in the southern Ruahine Range, including beech forest, podocarp-hardwood forest, and tūpare (leatherwood) scrub. Using 1995 colour aerial photographs, Geoff Rogers and John Leathwick mapped the degree of forest collapse in 33,500 ha of the southern Ruahine Range, then integrated this information with maps of the original forest types and topography in a Geographic Information System (GIS). The resulting maps show that forest has collapsed most severely in the podocarp-hardwood forests south of the Pohangina River, where 68-87% of the 20,000 ha of original tall forest has been replaced by scrub, low forest, tree ferns, and tussock. Beech-dominated forest to the north is much less affected, with about 28% of its former area

now in shrubland or tussock grassland. The tūpare scrub that dominates mountain summits is unaffected by possums and has expanded downwards by 32% (about 430 ha), replacing high-altitude forest.

Models predicting forest collapse

Geoff and John's models show that the original composition of forest is by far the strongest factor in predicting the susceptibility of forest to possum damage. Another important factor is the distance of beech forest from non-beech forest, as beech forest adjacent to podocarp-hardwood forest (containing plant species preferred by possums) is more susceptible to damage than beech further away.

In general terms, forests on steeper slopes, in the upper montane-subalpine zone, and on warm west and north aspects are more susceptible to modification by animals than elsewhere. Originally, these forests were dominated by mixes of tree species highly palatable to possums, such as northern rata, kāmahi, Hall's tōtara, kaikawaka, wineberry, and fuchsia.

Possums are responsible for the collapse of forest canopies, but deer and goats are responsible for inhibiting regeneration. Because possum numbers in the canopy and deer and goat numbers in the understorey peaked at the same time, the southern Ruahine Range forests appear to have suffered a greater amount of collapse than similar forest types elsewhere in New Zealand. Elsewhere, gradual disappearance of palatable species is often accompanied by expansion of unpalatable species. However, in the southern Ruahine Range few unpalatables were abundant enough to maintain the structural integrity of the forests.

Change of tall forest to scrub in the Ruahine Range. Only isolated living or dead trees remain from the once tall forest.

Outcomes of pest control

Possums are the main agent in opening up forest canopies. However, increased mechanical damage from wind, and secondary infection of weakened trees by fungi and insects lead to continued internal collapse of the stands. Whether these stands can recover after pest animals are reduced needs more research.

This research was funded by the Foundation for Research, Science and Technology.

Geoff Rogers *is in Landcare Research's Ecosystems North Team based in Hamilton and is studying the impacts of browsing animals on forests and tussock grasslands and threatened plant ecology.*

John Leathwick *is also in the Ecosystems North Team, and is studying forest/environment relationships, particularly predicting impacts of climate change on our native forests.*

Will Possums Become "Bait-Shy" in Control Programmes?

Recent research on possum behaviour towards 1080 baits is revealing something of this pest's resilience in the face of massive control efforts. Dave Morgan has been investigating what happens when possums eat only small sub-lethal baits and so survive a 1080 operation. Even though possum control agencies use baits made to tight specifications, undersize baits inevitably result from breakage during transport, handling, and usage.

Present possum control often involves an initial aerial operation using 1080 baits, most commonly made from carrot or extruded cereal. The bait also contains green dye to deter birds and cinnamon flavour to mask the 1080. After initial control operations, possum populations are usually maintained at low levels by repeated ground-based operations, often using the same type of 1080 bait as in the initial operation. However, there is growing suspicion that 1080 used in this way may be becoming less effective. Dave therefore set up an experiment to find out more about the possible occurrence of possum shyness to 1080 bait.

Possums trapped in an area of North Canterbury that had never been subjected to 1080 operations were settled in captivity at Landcare Research's animal research facility in Rangiora. A group of 85 individual possums were offered small pieces of cereal pellet baits, designed to be sub-lethal. All possums ate these bait pieces but when they were offered full-size baits two days later, most of them (64%) refused the baits. These possums had become shy towards the bait. When baits were presented to the shy possums again three months later, most were still shy.

Next, Dave offered the shy possums different bait types to see whether this would overcome bait shyness. Changing the bait flavour from cinnamon to orange had no effect. Similarly, changing the toxin from 1080 to brodifacoum did not work. However, when the bait type was changed from cereal pellet to carrot, most possums ate the baits and were killed. Possums therefore seem to remember the bait base material rather than the flavour or toxin, and most of them retain the memory for at least three months.

To confirm this, Dave then offered a group of the shy possums cereal pellets with no toxin, no added flavour, and no green dye. A group of possums unfamiliar with baits were offered the same type of bait. Only one out of fifteen possums that were unfamiliar with bait rejected the pellets, but six of the fifteen shy possums would not eat it. When green dye was added to the baits in a second experiment nine out of fifteen shy possums refused the baits

An unsuspecting possum eating a 1080 bait. If the bait is too small, the possum may well become "bait-shy".

compared with only one of the fifteen possums unfamiliar with bait. This confirmed that most possums learned to recognise the bait material, and that others may avoid baits when the green dye is added.

Dave now intends to test these findings in a field experiment in which extensive bait shyness will be created deliberately by presenting possums with sub-lethal cereal baits. After three months the effectiveness of alternative bait types will be compared with that of cereal baits.

The research team has also been developing new bait types, such as synthetic gels and pastes. If Dave's work confirms that possums learn to recognize and avoid bait, a range of alternative bait types may become essential if pest managers are to further improve possum control.

This work has been funded by the Animal Health Board and the Foundation for Research, Science and Technology.

Dave Morgan is currently working on improving possum control, specialising in bait development, animal behaviour, and chemical ecology. He is in Landcare Research's Pest Control Technology Team based at Lincoln.

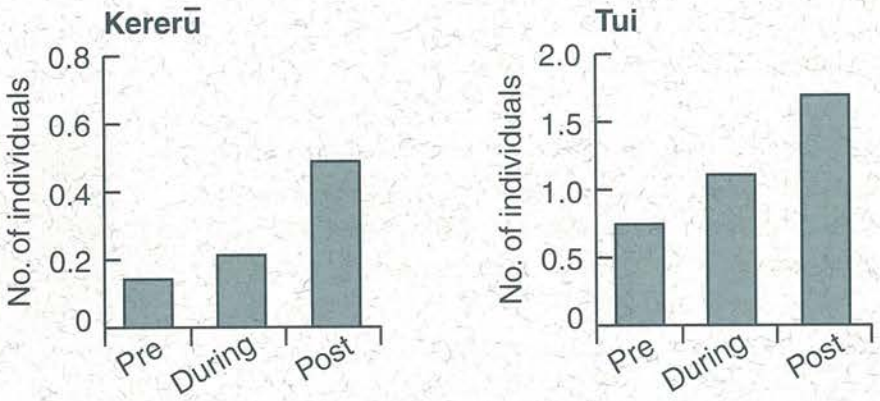
How does Possum Control Affect Native Animals?

Conservation managers usually assume that populations of native animals preyed on by possums or competing with possums for food will increase after possum control. However, the impact of control may not be quite so straightforward. Individual control operations may not reduce possum numbers to a level where they no longer harm native animal populations, and some control techniques also kill some native birds and invertebrates.

To complicate the situation, control operations may have unexpected side effects on numbers and behaviour of other predators and browsers within the same biological community. Aerial 1080 poisoning of possums was used for the first time in 1990 as part of the strategy to protect kōkako at Mapara Forest in the central North Island. The poison worked well on possums and killed nearly all the ship rats present as well. At first, this control of rats appeared a bonus because ship rats had probably been the most frequent predator of kōkako nests. But stoats, which had been eating the rats, then switched to eating birds. Any benefit for kōkako therefore depended on whether the stoats ate less kōkako than the ship rats and possums would have done, and whether significantly more food was available for kōkako once the possums were removed. John Innes of Landcare Research did find that kōkako numbers in Mapara increased significantly after several years of pest poisoning, showing a net benefit for kōkako.

Kōkako

We can achieve pest control on offshore islands with few predator species. But ultimately pest control needs to be effective in the complex biological communities on mainland New Zealand. To achieve this, we need more applied research at the community or ecosystem level,



Numbers of kererū and tui on Kapiti Island counted before (1975-78), during (1983-85) and after (1991-94) possum eradication (from Robertson & Beauchamp in prep.).

rather than looking at single-factor relationships in isolation, such as impact of possums on seedfall or kōkako.
One approach is to study the processes at work in biological communities affected by different scenarios for possums.

We can do this several ways:

- Eradicating possums on islands: This shows us what happens when possums are removed entirely from a biological community, e.g., when possums were eradicated on Kapiti Island some fruit and nectar-eating birds increased markedly (see graphs).
- Sustaining reduction of possum numbers at a mainland site: The response to possum control on the mainland is likely to differ from that on islands for two reasons: 1) it's impossible to eradicate possums; 2) introduced predators and herbivores interact with the remaining possums. Where possum control seems to have little effect on prey animal numbers, it could be because the remaining possums continue to kill the prey, because another predator species increases in importance, or because the possums were not limiting the prey in the first place.
- Monitoring areas newly colonised by possums: In some areas of New Zealand possum numbers have not yet reached their expected peak, e.g., parts of South Westland, Coromandel, and Northland. As possum numbers increase we could measure their effect by monitoring changes to native flora and fauna. This would give us an idea of what sort of recovery might be possible from the native flora and fauna if we reversed the trend and reduced possum numbers to their previous low numbers.

Drawing conclusions from studies of particular ecosystems is very difficult. Many factors are involved, and manipulating whole communities as an experiment requires considerable human resources and money, and may produce results only after many years. Large amounts of data are needed to unravel the complexities of biological communities. Such data can often be obtained from management programmes that support ecosystem research programmes.

This review incorporates research from the Department of Conservation, the Ornithological Society and Landcare Research.

John Innes *is currently working on managing the recovery of North Island kōkako populations, forest bird predation and rat control. He is in Landcare Research's Conservation Biology Team based in Hamilton.*

CAMPAIGN® a New Toxic Bait for Possum Control

CAMPAIGN®, a new toxic cereal bait containing cholecalciferol, is now available for use in bait stations to control possums. Farmers and community groups will be able to use it without a special licence.

This new bait has been developed by Landcare Research scientists on the basis of research that indicated possums were particularly susceptible to the toxic effects of calcium. Cholecalciferol acts by elevating blood and tissue calcium levels, leading to heart failure. Possums die within four to six days of eating bait. Of twenty new toxins screened by Landcare Research, cholecalciferol came out on top.

One feed of CAMPAIGN® contains a lethal amount of cholecalciferol so there is no need for pulse baiting. Field trials conducted with Regional Councils and DoC field biologists showed that CAMPAIGN® is more effective than anticoagulant toxins such as pindone for the initial 'knock down' of possum populations. Kills of between 80 and 90% are regularly achieved.

Poisoned carcasses pose a low risk of secondary poisoning, particularly when compared with 1080. Landcare Research scientists also believe that the baits will be less hazardous to birds than 1080 or brodifacoum. For example, the LD_{50} for cholecalciferol in the possum is <20 mg/kg but the LD_{50} for the mallard duck is >2000 mg/kg. Nevertheless, the risk of primary poisoning to dogs or cattle must not be underestimated, as the baits will be nearly as toxic to dogs as they are to possums, so that care in using bait stations and storing these baits is essential.

CAMPAIGN® will not replace 1080 or trapping, but it is another useful tool that will be readily available to farmers and community groups involved in self-help possum control activities.

This work was mainly funded by the Animal Health Board, AgrEvo (a subsidiary of Hoechst and Schering) provided resources and technical advice in the latter stages and a product license was granted by the Pesticides Board earlier this year. The new bait was launched by AgrEvo in July.

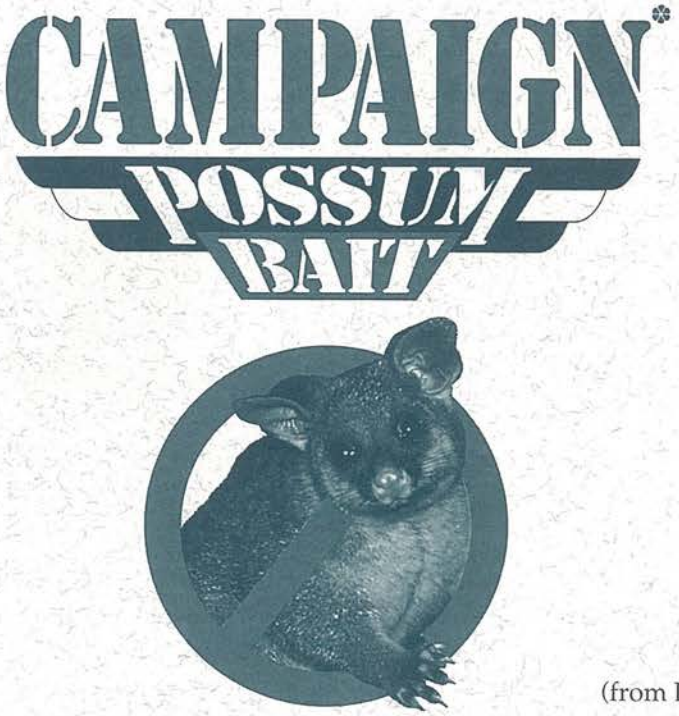
Charles Eason *is Team Leader of Landcare Research's Pest Control Technology team based at Lincoln.*

CAMPAIGN® is available from :

BASF Laboratories
Contact:
(Len Stulich, Richard Rose, Ross Hore)
Phone 09 634 4371
Fax 09 636 6901

Key Industries
Contact:
(Ross McLean, David Martin)
Phone 09 483 5526
Fax 09 483 9760

BOMAC Laboratories
Contact:
(Terry McCathis, Dr Bruce Vautier, Gavin Vercoe)
Phone 09 262 3169
Fax 09 262 3008



(from BASF)

Parasites & Diseases of Possums

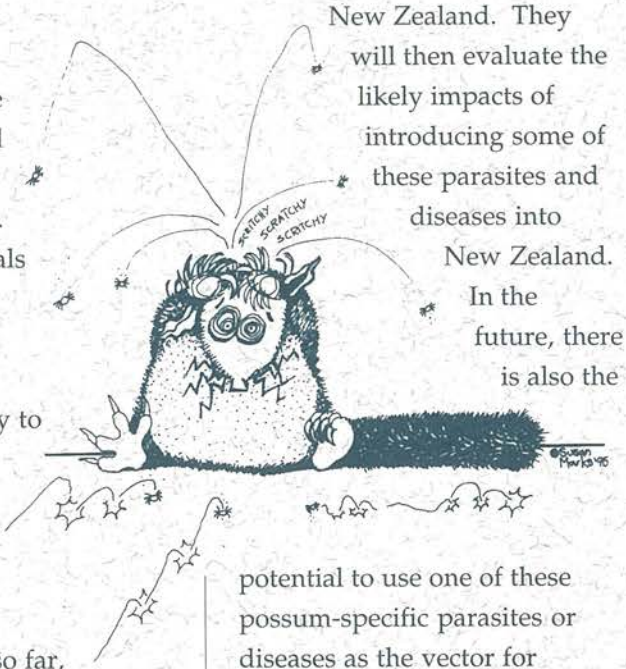
When possums were brought to New Zealand from Australia 100 - 150 years ago, some of the parasites and diseases that affect them were left behind. These "missing" parasites and diseases could be important biological control agents for reducing possum numbers in New Zealand. Unfortunately for New Zealand, our possums get one disease never recorded in them in Australia - bovine tuberculosis!

Landcare Research scientist Phil Cowan, in collaboration with staff from AgResearch, Massey University, MAF Quality Management, Department of Conservation, and Regional Councils, is finding out which parasites and diseases occur in possums in New Zealand. The group is hoping to maximize the chances of finding parasites and diseases by surveying possum populations at places where possums from Australia were originally released. So far, possums have been sampled from 12 sites, ranging from Kawau Island in the north to Stewart Island in the south, and on the Chatham Islands. One site in the Ruahine Ranges in Wairarapa is being sampled quarterly to look for seasonal variations in infection. A similar survey is being carried out in Australia by a consortium of Australian Universities and the CSIRO.

About 200 possums are trapped and autopsied at each site. Blood samples, various tissues such as lung and kidney, the intestines, and the skin are examined for internal and external parasites. Twelve live animals from each site are sent back to AgResearch and Massey University to be checked for viruses and bacterial infections.

Phil reports that so far, the surveys have found only three species of intestinal nematodes and one species of tapeworm (all previously recorded from possums in New Zealand), and from a couple of sites a possum fur mite (not recorded here before). However, what is interesting is that at most sites, one or more of the species of parasites already identified in New Zealand possums are missing. It may be that the parasites currently present do not spread very quickly. This means there is plenty of scope for artificially spreading parasites between possum populations and assessing their effects.

Once the Australian surveys have been completed in 1996, the team will assess what possum-specific parasites and diseases occurring in possums in Australia are missing from New Zealand. They will then evaluate the likely impacts of introducing some of these parasites and diseases into New Zealand. In the future, there is also the potential to use one of these possum-specific parasites or diseases as the vector for spreading a genetically engineered form of biological control to vaccinate possums against Tb or to stop possums breeding.



This collaborative project is supported by Funding from the Foundation for Research, Science and Technology and MAF Policy.

***Phil Cowan** works on possum ecology and biological control of possums. He is the leader of the Bovine Tb Team and is based at Landcare Research's Massey site, Palmerston North.*

Can Possum Densities be Used to Set Control Targets?

Recently, work began on a five-year study of the relationship between the density of possums and their impacts on forest vegetation, to determine whether possum density can provide a simple index of how much control is needed. At present, managers control possums to the lowest level they can and assume it is low enough. If possums are controlled at a level lower than is actually needed to protect the valued resource, some of the effort is wasted.

If we knew the maximum possum densities at which impacts on each valued resource were acceptable, assessment of pre-control possum densities could indicate not only when (or if) control action is required, but the level of control needed. Further, assessing possum densities after control operations, would immediately show whether the level of control achieved was adequate. All this would be particularly useful for those planning maintenance (repeat) control operations where for instance, residual populations (of say 30-40%) may be sufficient to protect certain conservation values.

Ngaire Dawson, with assistance from Kees Pekelharing and Graham Nugent, has started a project in diverse coastal forest near Mt Robertson, Blenheim. Possums have been present for about 50 years and peak browsing pressure probably occurred about 20 years ago. The area (about 1000 ha) has been divided into four blocks, and different levels of possum control will be maintained in each block for the next five years. Over that time, the condition of six "indicator" canopy species (plant species preferred by possums and susceptible to damage) will be monitored in each block. Change in canopy condition has been chosen because it provides a relatively easy method of measuring possum impact. Since April of this year, Ngaire, Kees, and colleagues have tagged and measured the canopy condition of almost 1300 trees.

Pre-control possum densities, assessed using the trap-catch method (100 traps set for three fine nights), were high in all four blocks (up to about 12 possums per hectare). This suggests that the carrying capacity in this forest is high relative to other forest types. Ngaire's team left one of the four blocks untouched and reduced possum densities in the other three blocks by 30%, 70%, and 90%.

Although the pre-control data have yet to be fully analysed, impacts of possums were high on tawa, tītoki, kāmahi, and tōtara, particularly at low and mid-elevations. Moderate-to-light browse was also noted on toro, māhoe, and southern rata. Some rata trees had extensive crown dieback. For tawa, hardly any fruit was seen on the trees or on the ground. In contrast, tawa fruit was abundant in another study undertaken in the same ecological region and same time of year in the Otari Native Botanic garden, Wellington, where there had been a highly successful possum control operation.

Impacts of possums on the locally occurring large land snail (*Powelliphanta hochstetteri bicolor*) also appears high in the Marlborough study site, with more than 70% of the shells collected showing signs of possum predation. The DoC Nelson Conservancy intends monitoring snail populations within the study area.

This project is funded by the Department of Conservation.

***Ngaire Dawson** is currently working on possum impacts on key plant species and native plant and animal resource issues involving iwi. She is a researcher in Landcare Research's Ecological Impacts Team based at Lincoln.*

Conferences

Pest Control Conference: May 1995

The 10th Australian Vertebrate Pest Control Conference was convened in Hobart in May 1995 under the approval of the Agriculture and Resource Management Council of Australia and New Zealand. Approximately 125 delegates (25 from New Zealand) from pest management and research backgrounds attended the conference. Eighty papers were presented on a wide range of pest issues and these are now available in the Conference Proceedings.

Major themes covered at Hobart include improved integrated pest management, the delivery of vertebrate toxins (especially 1080), public perceptions of pest control, assessing and controlling pest damage, control of rabbits, epidemiology and modelling of pest diseases, fertility control, and animal welfare. The themes were built around the improved management of rats, mice, cats, foxes, dingo, pigs, possums, rabbits, goats, kangaroo and camels.

The conference was very wide ranging and the proceedings are essential reading for those working in pest management.

Copies are still available at $A30 from:

Dr M Statham
Department of Primary Industry & Fisheries
PO Box 46,
Kings Meadows, 7249 TASMANIA

Pest Summit '95: July 1995

In May 1993, Environment Waikato convened a national conference at Taupo on the management of vertebrate pests in New Zealand. The conference was the first of its kind in New Zealand for many years. It gave rise to several positive outcomes including increased funding for pest management and the formation of a National Possum Co-ordinating Authority. In July 1995, the Otago Regional Council convened a follow-up pest summit aimed at reviewing progress in the planning of pest management since 1993, and at furthering understanding of the Biosecurity Act. Conference delegates heard 24 presentations covering such topics as the content, consultative process, and enforcement of the Act. Also covered were, agriculture security, the development of Pest Management Strategies (PMS's), and case studies of National and Regional PMS's. Major recommendations from the conference included a request for the immediate redrafting of numerous clauses in the Act, a stronger commitment by the Crown to the "good neighbour" principle, and increased linkages between the Regional Council Biosecurity Working Group (BWOG) and industry groups involved in the development of National PMS's.

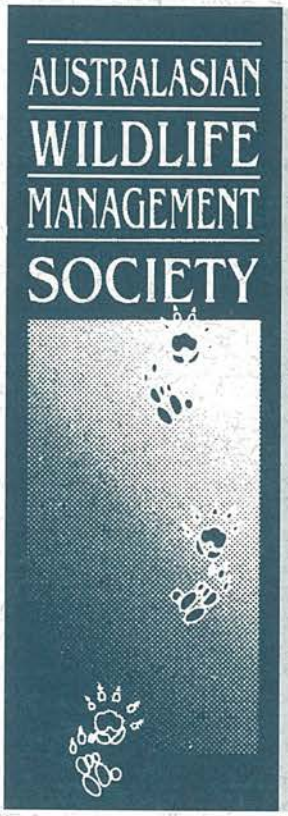
Proceedings from the Pest Summit will go out to all delegates.

TB Conference: August-September 1995

The second international conference on bovine tuberculosis (Tb) was held in Dunedin from August 28th to September 2nd, 1995. This five day conference covered topics such as molecular biology, immunology and vaccination, disease control, epidemiology, population modelling, and vector ecology. It enabled all those interested in the research and management of bovine Tb to exchange ideas on a wide range of topics and vector species.

Copies of the proceedings (cost of approx. $60) are available from:

Dr Frank Griffin
Dept. of Microbiology
University of Otago
PO Box 56, Dunedin



8th Australian Wildlife Management Society (AWMS) Conference

4 - 7 December 1995

Christchurch, Aotearoa - New Zealand

Symposia Themes:

Rabbit Calicivirus Disease (RCD) & Biocontrol
Indigenous People in Wildlife Management
Wildlife Management for Species Diversity

There will also be 'open sessions'
- papers on all aspects of wildlife management welcomed.

If you are a member of AWMS, you will automatically receive further information shortly. If you are not a member, and wish to attend, please contact:

Ian Rivers, Conference Co-ordinator
PO Box 29060
Christchurch, NZ.

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A Selection of Recent Possum Publications

Caley, P.; Hickling, G.J.; Cowan, P.E. 1995: Sustained control of possums to reduce bovine tuberculosis in cattle and possum populations in New Zealand. *Proceedings of the 10th Australian vertebrate pest control conference, Hobart, Tasmania - May 1995:* 276-281.

Eason, C.T. 1995: Sodium monofluoroacetate (1080): An update on recent environmental toxicology data and community concerns. *Proceedings of the 10th Australian vertebrate pest control conference, Hobart, Tasmania - May 1995:* 39-43.

Fraser, K.W. 1995: Public attitudes to introduced wildlife and wildlife management in New Zealand. *Proceedings of the 10th Australian vertebrate pest control conference, Hobart, Tasmania - May 1995:* 101-106.

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Nugent, G. 1995: Effects of possums on the native flora *in* O'Donnell C .F. J. (compiler). *Proceedings of a workshop on possums as conservation pests. Possum and bovine Tb NSS Committee, 29-30 November 1994, Christchurch.* Department of Conservation, Wellington. Pp 101-106.

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Thomas, M.D.; Frampton, C.M.; Briden, K.W.; Hunt, K.G. 1995: Evaluation of brodifacoum baits for maintenance control of possums in small forest reserves. *Proceedings of the 48th New Zealand plant protection conference:* 256-259.

Warburton, B. 1995: Setting standards for trapping wildlife. *Proceedings of the 10th Australian vertebrate pest control conference, Hobart, Tasmania - May 1995:* 283-287.

Warburton, B.; Hall J.V. 1995: Impact momentum and clamping force thresholds for developing standards for possum kill traps. *New Zealand journal of zoology, 1995, Vol 22:* 39-44

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